1 If M & N are Perpendicular to each other

$M \cdot N = (P\hat{i} - 6\hat{j} - 3\hat{k}) \cdot (4\hat{i} + 3\hat{j} - \hat{k})$

$= 4p - 18 + 3$

$= 4p = 15$

Since they are perpendicular

$4p - 15 = 0$

$4p - 4 = \frac{15}{4}$

$p = \frac{15}{4}$

b) M, N, O are co-planar

$M \cdot (N \times O) = \begin{bmatrix} p & -6 & -3 \\ 4 & 3 & -1 \\ 1 & -3 & 2 \end{bmatrix}$

$= p \begin{bmatrix} 3 & -1 \\ -3 & 2 \end{bmatrix} + 6 \begin{vmatrix} 4 & -1 \\ 1 & 2 \end{vmatrix} - 3 \begin{vmatrix} 4 & 3 \\ 1 & -3 \end{vmatrix}$

$= p(6-3) + 6(3+1) - 3(-12-3)$

$= 3p + 54 + 45 = 0$

$3p + 9p = 0$

$\frac{3p}{3} = \frac{9p}{3}$

Scanned with CamScanner

$$\cos\beta = \frac{a_y}{|v|} = \frac{3}{13.15} = 0.228$$

$$\cos\gamma = \frac{a_z}{|v|} = \frac{8}{13.15} = 0.608$$

(i) unit vector

$$e_v = \frac{v}{|v|} = \frac{10i + 3j + 7k}{13.15}$$

3 $F = 3ui + v^2 j + (u+2)k$

$v = 2ui - 3uj + (u-2)k$

$$F \times v = \begin{vmatrix} i & j & k \\ 3u & u & (u+2) \\ 3u & 3u & (u+2) \end{vmatrix}$$

Scanned with CamScanner

$$= i\begin{vmatrix} u & (u+2) \\ -3u & (u+2 \end{vmatrix} - j\begin{vmatrix} 3u & (u+2) \\ 3u & (u-2) \end{vmatrix} + k\begin{pmatrix} 3u & v^2 \\ 2v & -3u \end{pmatrix}$$

$$= i[u^3 + u^2 + 6u] - j[u^2 + 10u] + k[-2v^2 + 9u^2]$$

$$\int_0^1 (F \times V) = [\,i[u^3 + u^2 + 6u] - \int 1[v^2 - 10u]$$

$$= \left[\frac{u^4}{4} + \frac{u^3}{3} + 3u^2\right] - j\left[\frac{u^3}{3} - 5u^2\right] + k\left[\frac{(1)}{2} - 3(1)^3\right] k - (0+C)$$

$$\int_6^1 (F \times V) = i\left[\frac{1}{4} + \frac{1}{3} + 3\right] - j\left[\frac{1}{3} - 5\right] + k\left[\frac{-1}{2} - 3\right] - 4 + u$$